



## Technology Evaluation for Environmental Risk Mitigation Principal Center

### Oxygen Systems Cleaning

JG-PP Project Number: J-99-CL-015

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### Project Summary

Maintaining the cleanliness of oxygen lines is paramount to the safety and well being of aerospace vehicle crewmembers. When contamination is discovered, the lines must be cleaned. This used to entail dismantling and removing the oxygen lines from the aircraft, cleaning with chlorofluorocarbons (CFC-113) and hydrochlorofluorocarbons (HCFC-141b), and then reinstalling on the vehicle. This procedure resulted in emissions of ozone depleting substances (ODSs), high labor costs, and long periods of aircraft downtime.

The project was aimed at demonstrating, validating, and qualifying multiple technologies that would eliminate the use of ODS and result in cost avoidances. Two technologies were chosen for testing, HFE-7100 and an aqueous cleaning system. HFE-7100 was used in a transportable onboard solution as a direct replacement for the ODSs, while the aqueous cleaning system was used in several off-board demonstrations. Both solutions met the acceptance criteria from the Joint Test Protocol (JTP) and modified testing specifications from the Joint Test Report (JTR).

The exact benefits have not been fully reported, however it is estimated that these alternatives can result in cost avoidances of up to \$1 million per aerospace vehicle by eliminating the consumption and emission of tens of thousands of gallons of CFCs annually and reduction of labor costs and aircraft downtime. These technologies can also potentially be applied to other applications such as oxygen lines for tanks, machinery, and hospitals.

National Aeronautics and Space Administration (NASA)'s participation in the project included assistance in developing the JTP and identifying suitable cleaning products for testing. NASA had full intention of implementing; however at the conclusion of the project, many Centers had already implemented their own non-ODS cleaning technology or other solutions. Knowledge gained from this project is being used in a NASA Technology Evaluation for Environmental Risk Mitigation (TEERM) follow-on project to evaluate next-generation oxygen system cleaning products as substitutes for Class II ODSs such as HCFC-141b. The JTP is expected to be very similar to that of this successful project.